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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 294,

For the Week ending August 20, 1881.

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NON-EXPLOSIVE KEROSENE.

Very frequently of late we have received from correspondents, East and West, samples of "stuff" sold them by peddlers with the assurance that when a little of these preparations are mixed with the poorest burning oil the latter is rendered *perfectly safe*. Of course one of the chief inducements to use these compositions is the assurance that with them a much cheaper oil of equal illuminating power can be used safely.

This fraud is a very dangerous one, and perhaps the best way to stop it is by the diffusion of a little practical information respecting these oils.

In the first place, there is nothing that can be added to or mixed with poor kerosene oil that will in the least affect its dangerous qualities or make it any safer to use in lamps. The danger with such oils arises solely from the presence in them of light, easily volatilized, and very inflammable hydrocarbons, such as naphtha, the vapor of which, when mixed with air, explodes on contact with flame.

Kerosene and naphtha or benzine are derived by a process of distillation from the same substance—petroleum. The lighter oils—gasoline, naphtha, benzine, etc.—are first volatilized and condensed. As the products distill over they are tested from time to time with a hydrometer, and when it is found that the stream of distilled oil marks about 58° (Baume's hydrometer), what follows is turned into another tank until it is found that the gravity of the oil coming over has risen to about 40°, then the stream is deflected into another tank. The oil distilled between 58° and 38° is called kerosene or burning oil.

In this process about 15 per cent of the light oils are produced, and as there is comparatively little demand for them they are very cheap. Naphtha costs from 2 to 5 cents a gallon, while good kerosene costs from 20 to 25 cents. As great competition exists among the refiners there is a strong inducement to turn the heavier portions of the naphtha into the kerosene tank, so as to get for it the price of kerosene or to cheapen the latter. They change the direction of the stream from the still when it reaches 65° to 63° B., instead of waiting until it reaches 58°; and thus the volatile inflammable naphtha or benzine is allowed to run into the kerosene, rendering the whole of the latter dangerous. It has been shown that one per cent of naphtha will lower the flashing point of kerosene ten degrees, while with twenty per cent of naphtha the same oil will flash at eight degrees (Fah.) above the freezing point of water. It is, therefore, the cupidity of the refiner that leads him to run as much benzine as possible into the kerosene regardless of the consequences.

The specific gravity is not a safe guide respecting the character of such oils, as a poor dangerous oil may be heavier than a safe oil. Astral oil illustrates this. While it does not flash below 125° Fah., its gravity is 49° B. Poor kerosene flashes at 86° Fah., but has a gravity of 47° B.

Kerosene when properly refined is nearly colorless by transmitted light and slightly fluorescent by reflected light. Its density should be about 43° B. At ordinary temperatures it should extinguish a match as readily as water without becoming inflamed or *flashing*, and when heated it should not evolve an inflammable vapor below 110° Fah., and should not take fire below 125° to 140° Fah.

As the temperature in a burning lamp rarely exceeds 100° Fah., such an oil would be safe. It would produce no vapors to mix with the air in the lamp and make an explosive mixture, and if the lamp were overturned or broken the oil would not take fire.

The standard which has generally been adopted by law as a safe one fixes the flashing point at 100° Fah., or higher.

Professor Chandler, President of the New York City Board of Health, says: "Out of 736 samples of kerosene oil tested by me, only 28 were really safe, all the rest evolving inflammable vapor below 100° Fah." In his paper on the temperature of oil in lamps (*American Chemist*, August, 1872, p. 43) Dr. Chandler has shown that in some cases the temperature of their contents often rises above 100° Fah.

STATE TAXATION OF PATENTED ARTICLES.

We publish, in another column, an interesting decision by the Supreme Court of the United States, in which the question of the right of a State to enforce its local tax or license laws as against the sale of patented articles is once more considered and adjudicated. The defendant having refused to pay a county tax in Henrico County, Va., was indicted and found guilty. One of the points in the defense was that the sales related to patented articles, and that no State had a right to hinder such sales by taxation.

On appeal, the United States Supreme Court decides, in this case (and it has so held in other cases), that venders of patented goods must, like other people, conform to the State laws. The patent laws, it is true, confer on patentees the exclusive right to sell their inventions and discoveries, but this does not apply to tangible property or goods. The patentee may sell rights, licenses, and privileges of all kinds under his patent, and no State has the right to interpose any law, tax, or penalty to hinder or prevent such selling. This patented right relates to the invention or discovery, and is an incorporeal right which the State cannot interfere with. But whatever rights are secured to inventors must be enjoyed in subordination to the general authority of the State over all property within its limits. Hence the State may tax all sales of goods, whether they are patented or not. No tax, however, can be imposed upon a patent, or on any sales relating to rights thereunder.

The Supreme Court also held, in the case above referred to, that all State laws that discriminate in favor of citizens resident in such State, and against citizens of other States, are invalid. The State of Virginia cannot exempt its own citizens from license taxes, and impose them upon citizens of New York when they visit Virginia. To do so would be to regulate commerce, which, under the Constitution, is a national, not a State, right.

BUTTER COLORING.

It is a fact not generally known that much—it might be said nearly all—of the butter offered for sale in our large cities owes its "rich golden color" to artificial additions. The dairyman, as well as the butter dealer, has found that butter of a *good color* commands a readier sale than pale butter, and as a color is so easily and cheaply procured the temptation to improve (or, at least, to equalize) the natural tint of the commodity is not to be resisted. As long as the coloring matters used are harmless there can be no valid objection urged against the practice, and we have no reason to believe that anything really pernicious has thus been introduced into our food—at least of late years.

The coloring matters commonly employed are annatto and turmeric, or extracts of these; but there are also a number of butter-coloring compounds or mixtures sold for this purpose. For some of these it is claimed that they will not only impart the desired color to butter, but will keep it sweet and *fresh* for an indefinite time. The following are a few of these coloring compounds in use at present. Rorick's compound is prepared as follows:

The materials for 1,000 pounds of butter are:

Lard, butter, or olive oil	6	pounds.
Annatto	6	ounces.
Turmeric	1	ounce.
Salt	10	ounces.
Niter	¾	ounce.
Bromochloralum	3½	ounces.
Water	q. s.	

The lard, butter, or oil is put into a pan and heated in a water bath. The annatto and turmeric are then stirred into a thin paste with water, and this is gradually added to the fatty or oily matters kept at a temperature of about 110 Fah. The salt and niter are next stirred in, and the mixture heated to boiling. The heating is continued for from twelve to twenty-four hours, or until the color of the mixture becomes dark enough. The bromochloralum is then introduced and the mass is agitated until cold, when it is put up in sealed cans.

Bogart's preparation is prepared as follows:

The materials employed are:

Annattoine	5 ounces.
Turmeric (pulverized)	6 "
Saffron	1 ounce.
Lard oil	1 pint.
Butter	5 pounds.

The butter is first melted in a pan over the water bath and strained through a fine linen cloth. The saffron is made into a half pint tincture, and, together with the turmeric and annattoine, is gradually stirred into the hot butter and oil and boiled and stirred for about fifteen minutes. It is then strained through a cloth as before and stirred until cool.

Dake's butter coloring is prepared by heating a quantity of fresh butter for some time with annatto, by which means the coloring matter of the butter is extracted, and straining the colored oil and stirring it until cold.

THE TAILS OF COMETS.

Camille Flammarion, in a paper read before the French Academy of Sciences, on the recent comet, says:

In my observations on this comet I have devoted myself principally to an examination of its physical aspect. This examination appears to lead to conclusions which are different from the opinions generally adopted as to the nature of cometary tails. . . . The perfect transparency of these trains of light leads us to think that they are *not material*, that they are not gases driven back into space by a repulsive solar force, but that they are an excitation—electric or otherwise—of ether produced by the mysterious star, on the side opposite from the sun, we might almost say in the line of its shadow!

On the 24th of December, 1811, Piazzi observed at Palermo, through the tail of the celebrated comet of that year, the stars P.XX., 149, and P.XX., 197, which, instead of being more or less obscured, were seen to be *more luminous*. . . . Apropos of these unexplained physical phenomena, let us dwell for a moment on the assuredly extraordinary circumstance which occurred last year, and which was only the renewal of one of the same kind observed already in 1843. On the 28th of January, 1880, at 36 minutes past 11 o'clock in the morning, the great comet discovered in the Southern hemisphere passed to its perhelion at 150,000 miles only from the solar surface. In adopting the figure 90,000 miles as the diameter of the head—the figure generally adopted also for the comet of 1843 (which, moreover, appears to be definitely the same as that of 1880), we see that from surface to surface there was only 108,000 miles. The proximity was more surprising still on the 27th of February, 1843. The two celestial bodies brushed each other at 33,000 miles only—that is to say, the comet traversed the solar atmosphere at a height less than that of the corona, and even of that of the protuberances, several of which have been ascertained to measure 200,000 miles in height. Now at these two epochs the comet was accompanied by a narrow and rectilinear train, which it car-

ried with it always on the side away from the sun, and which stretched out 125, 150, and even 200 millions of miles in length. To make in two hours a half revolution of the sun, it rushed along with a velocity of 167,700 feet per second (perhelion of 1843)—a velocity of the elliptical order, considering the fearful attraction of the sun, but which would have become rapidly parabolic at a little greater distance. Now at the distance of the earth, at 95 millions of miles, the rectilinear and rigid tail must have swept space with a velocity of over 19,500,000 feet per second!

Does not this circumstance, which has presented itself to our eyes twice in thirty-seven years, taken in connection with the perfect transparency of these trains of light, lead to the consequence that *the tails of comets cannot be material?* Is it an electrical illumination of the ether? Is it an undulatory motion excited by the comet itself on the side opposite from the sun? We do not as yet know all the forces of Nature.

A STRANGE EXPLOSION.

To the Editor of the Scientific American:

I was recently called upon by Professor S. P. Langley, Director of the Alleghany Observatory, to silver three heliostat mirrors for him that he intended to use in his present expedition to the Sierra Nevada Mountains. These mirrors he wanted with a surface as perfect as could be made, and they were to be so bright from the bath as to need absolutely no retouches with a polishing pad, as the microscopic scratches produced by the pad would be detrimental to his experiment. The silvering was a success; a beautiful and fine reflecting surface being obtained from the bath.

In making one of the solutions, I had put 240 grains nitrate silver in 2 oz. distilled water, and 240 grains absolutely pure potassa in the same amount of water; each in separate vessels. I now poured them together, with the usual result. The silver was precipitated in the form of a grayish brown oxide. I then poured in aqua ammonia to redissolve the silver, but for some cause unknown to me, after pouring in fully seven ounces of ammonia, three times the usual amount, the precipitate would not dissolve, and I gave it up for a bad job, as an excess of ammonia always causes a thin deposit of silver. I poured the solution into a pint jelly glass and set it on top of my writing desk with simply a bit of paper over it to keep the dust out.

Three days afterward, at about two o'clock in the afternoon, I sat down at the desk to answer a letter, but before I finished it I was called out of my shop, and I think I was not away three minutes when a fearful explosion was heard in the shop. I hurried in, as also did the neighbors, and I found my shop literally strewn with glass fragments of silvering dishes, bottles, graduates, and funnels, and the sides of the shop floor and roof splattered all over with particles of glass as fine as dust. Every place the solution had touched was turning brown. The crash was heard for a great distance, and the wreck was complete. The force of the explosion caused the bottom of the glass to embed itself fully a quarter of an inch deep into the hard cherry wood, showing that it must have been very powerful, the glass itself being blown into atoms. The thermometer marked 96 in the shade about the time of the explosion. Now I would like some of your chemical readers to explain this, if it is explainable. Did the fulminate of silver form in any way? The vessel being open a gas could not have done such destructive work. It was fortunate for me that I was called out when I was, or I should likely have lost a pair of valuable eyes. Of course I shall leave no such solution stand even uncovered hereafter. Nevertheless I should like to know what caused the explosion.

I. A. BRASHEAR.

Pittsburg, Pa., July 23, 1881.

[REMARKS.—The explosive in Mr. Brashear's case was Berthollet's fulminating silver, a very curious and dangerous substance which results from the action of ammonia on oxide of silver. A very good receipt for producing it, is as follows: Digest freshly precipitated oxide of silver in strong liquor of ammonia for twelve or fifteen hours, then pour off the liquid, and cautiously dry the black crystalline powder which remains and which is the fulminate. Also the decanted ammonia contains some fulminate, and this will be deposited on cooling after gentle warming of the liquid or on spontaneous evaporation. Only a very few grains of oxide of silver should be used in a single operation.

Mr. Brashear had in his jelly glass freshly precipitated oxide of silver and ammonia, and the digestion went on, all as the receipt prescribes. There was also in the glass nitrate of potash, which probably was an inactive substance, for it did not prevent the formation of the fulminate. Perhaps there was present for the explosion about as much fulminate as was possible to produce from 240 grains of nitrate of silver.

The Berthollet fulminate is one of the most unmanageable and dangerous of known explosives. One writer says: "This compound is exploded by the slightest friction or percussion, and should therefore be only made in very small quantities at a time and handled with great caution. Its explosive powers are tremendous; in fact it can hardly be handled with safety, even in the moist state. Many frightful accidents have happened from the spontaneous explosion of this substance."

It is a singular fact that this fulminate is mentioned by only a few of the modern treatises on chemistry, and that although it was discovered in the last century very little is known of its chemical relations. The fullest accounts of it are to be found in books which are now obsolete. We quote a few sentences about it from Akin's Dictionary of Chemistry, London, 1807: "Even when still wet if it be pressed upon with a hammer, or any hard body, it fulminates with extreme violence, but when dry, the touch of a slender wire or even a feather, or a heat of about 96° is sufficient to make it explode. Even a moderate concussion of the air is sufficient, so that a heap may be exploded by the concussion of any other in its immediate neighborhood. Sometimes too it will go off in the hand, when carrying from one place to another, so that in fact when it is once dry, the operator should be prepared for the explosion at any time, even with the most careful handling."

Berthollet's fulminate must not be confounded with the ordinary fulminate of silver which is employed in the toy torpedoes, and which is made by heating a mixture of nitrate of silver, alcohol, and nitric acid. The latter, although a terrific explosive, is comparatively safe.—ED.]

DUST EXPLOSION IN EHRET'S BREWERY.

The splendid building owned and occupied by Mr. Geo. Ehret, as a lager beer brewery, located between 92d and 93d streets, and 2d and 3d avenues, N. Y., was injured on the 30th of July, 1881, by an explosion of malt dust, which also set it on fire. It is one of the finest breweries in the country, seven stories high, and ornamented elaborately with insignia of the business and samples of fine bricklaying. Our engraving gives an idea of the magnitude of the structure. The crushed malt from the malt crushing machines in the lower part of the building is carried by an endless belt elevator through a closed box to an upper chamber in the top of the tower, whence the malt is distributed for brewing through spouts to all parts of the building. The fine dust occasioned by the crushing is suspended in

DUST EXPLOSION IN EHRET'S BREWERY.

the air in the chamber, and in this condition it will burn with explosive rapidity when ignited. The distributing chamber of the central system of this establishment was located on the upper floor, formed by a light transverse partition in the room beneath the clock tower, the lower end of the elevator being on the third floor, just below the crushing rolls which were on the fourth floor. The initial explosion, which was followed by two or three secondary ones, or noises like explosions, and the fire, took place at or near the upper part of the elevator case, bursting out a small area of perhaps its weakest part. The margin of the opening was scorched and splintered, but not set on fire, and the ceiling boards in the vicinity were also scorched as though they had been exposed to a flash of gunpowder.

The fire, however, appears to have originated in the attic above the malt bins in the western wing, which was probably the location of the second, and, perhaps, third explosions, if such really occurred. To persons inside of the building the falling of the bricks into the street and upon the roof of the two-story extension might have been mistaken for explosions of dust. The flat portion of the main roof of the western wing was lifted and took fire, and the iron stairway and ornamental railings were broken and thrown about. The sloping mansard roof at the western end, together with the metal cornice and the upper part of the brick wall, was blown out and fell through the roof of the two-story extension of the western wing into the dry room above the boilers, luckily going no farther in that direction. Near the location of the initial explosion at the center of the north front, the ornamented gable of the transept was blown out and fell into the street, where some very narrow escapes of people from sudden destruction are said to have occurred. The timely appearance of firemen upon the scene and their prompt efforts soon subdued the flames and saved this fine structure, but a large quantity of stored malt was ruined by water.

In regard to the frequency of this class of explosions, the *Times* has the following:

"Mr. Hasslocher, the superintendent, and several of Mr. Ehret's employes, spoke of the occurrence as being far from extraordinary. On the 4th of July, 1880, a common lucifer match among the malt was ignited in the malt mill, in which are two steel grinders, which make about 150 revolutions a minute. The flash of the match set fire to dust in the elevator, and an explosion occurred which did about $2,000 damage. Similar explosions have recently occurred at Hupfel's brewery and at Ruppert's. A pebble or a piece of steel among the malt in the mill could produce a spark which, if it came in contact with the saccharine fine dust in the elevator, would cause either a flash or an explosion according to the quantity of dust in the air. Just as good a flash can be produced with this malt dust as with lycopodium spores, which were once used in theaters to simulate lightning."

The same journal also says of the lecture of Prof. L. W. Peck, which was delivered in May, 1878: "He illustrates the theory that dust mixed with air is not only combustible, but explosive, by saying: 'If a large log of wood were ignited it might be a week before being entirely consumed. Split it up into cord wood, and pile it up loosely, and it would burn in a couple of hours. Again, split it up into kindling wood, pile it up loosely, and perhaps it would burn in less than an hour. Cut it up into shavings and allow a strong wind to throw them in the air, or in any way keep the chips comparatively well separated from each other, and the log would, perhaps, be consumed in two or three minutes; or, finally, grind it up into a fine dust or powder, blow it in such a manner that each particle is surrounded by air, and it would burn in less than a second.' Prof. Peck instanced the burning of the Washburn, Diamond, and Humboldt Mills on the 2d May, 1878, at Minneapolis. This fire was due to the explosion of particles of flour and bran mixed with air, and the force of the explosion was so great as to throw down walls six feet thick, and sheets of iron from the roof of the Washburn Mills were thrown so high in the air that they were carried away by the wind a distance of two miles. He also cited the fire in Greenfield's candy factory, in Barclay street, New York, on the 20th of December, 1877, as one which 'no one need regard as a mystery,' as large quantities of starch and sugar were kept there, and could have been thrown into the air by minor disturbances. Prof. Peck, by numerous and interesting experiments, demonstrated the explosive force of fine dust mixed with air and ignited under proper and favorable conditions. The lid of a box of two cubic feet capacity, with a man standing on it, was raised when flour blown on to a light within was ignited. In a similar experiment, dust from a factory gave similar results."

In the back volumes of the SCIENTIFIC AMERICAN and SUPPLEMENT will be found recorded a number of cases of disastrous dust explosions. One of the most fearful was that which took place at the Albion coal mines, Nova Scotia, last year.

Another Trial of the English Yacht Anthracite.

A recent letter from the Secretary of the Perkins Engine Company, Major George Dean, of London, England, informs us that a third economic trial of the machinery of the little Anthracite has lately been made by F. J. Bramwell, Esq., C.E., F.R.S., assisted by William Rich, Esq., C.E., while the vessel was running under steam on the river Thames. The letter accompanies an extended report of the three rigid trial tests that have now been made, the first and last of which were conducted by Mr. Bramwell, while the yacht was running on the river Thames, and the second, by a Board of United States Naval Engineers, Chief Engineer C. H. Loring, President, pursuant to orders from the Secretary of the Navy, while the vessel was tied to the wharf in the New York Navy Yard, August 13 and 14, 1880.

This vessel was fully described in current numbers of the SCIENTIFIC AMERICAN and SUPPLEMENT, and illustrated in the SCIENTIFIC AMERICAN, under date of August 7, 1880, by means of a large engraving, which shows her in elevation and section, and her machinery somewhat in detail.

It appears from the last report that since her successful voyage to America, the yacht has been fitted with a new propeller, and that she now has beaten her own record both as to power developed and economic performance, yielding a horse-power at the expense of 1·66 pounds of coal, and showing a gross of about 110 indicated horse-power, against 1·7 pounds of coal at the first trial, and 2·7 pounds at the second trial, with, respectively, a gross development of 80·9 and 80·15 horse-power. In regard to the apparently wide difference between the American and the first English tests, the Report of the Naval Board says: "A cursory glance at the cost of the indicated horse-power, in pounds of coal consumed per hour during the two experiments, shows the wide difference between 2·7115 pounds in our experiment and 1·7114 pounds in Mr. Bramwell's, or that the economic results in the latter were $\left(\frac{(2\cdot7115-1\cdot7114)\,100}{2\cdot7115}\right)=36\cdot88$ per centum superior to those in the former. This great difference, however, is only found when the crude coal is employed as the measure of the cost, and it includes not only the difference due to the condition of the steam (meaning as to superheat) in the two experiments, but the difference in the evaporative power of the coals."

Major Dean in his letter properly says of these trials: "Though differing, all bear such a favorable testimony to the value of the Perkins system, that the comparison will do much to help those interested in steam to judge for themselves as to the advantages claimed."